Seasonal Variability of Saturn's Atmosphere

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The seasonal variability of Saturn's clouds and weather layer, currently displaying a variety of phenomena (convective storms, planetary waves, giant storms and lightning-induced events, etc.) is not yet fully understood. Variations of Saturn's radiance at 5.2 microns, a spectral region dominated by thermal emisison in an atmospheric window containing weak gaseous absorption, contain a strong axisymmetric component as well as large discrete features at low and mid-latitutdes that are several degrees colder than the planetary average and uncorrelated with features at shorter wavelengths that are dominated by reflected sunlight (Yanamandra-Fisher *et al.*, 2001. *Icarus*, Vol. 150). The characterization of several fundamental atmospheric properties and processes, however, remains incomplete, namely: How do seasons affect (a) the global distribution of gaseous constituents and aerosols; and (b) temperatures and the stability against convection and large scale-atmospheric transport? Do 5-micron clouds have counterparts at other altitude levels? What changes occur during the emergence of Great White Storms? Data acquired at the NASA/IRTF and NAOJ/Subaru from 1995 – 2011; since 2004, high-resolution multi-spectral and high-spatial imaging data acquired by the NASA/ESA Cassini mission, represents half a Saturnian year or two seasons. With the addition of detailed multi-spectral data sets acquired by amateur observers, we study these dramatic phenomena to better understand the timeline of the evolution of these events. Seasonal (or temporal) trends in the observables such as albedo of the clouds, thermal fields of the atmosphere as function of altitude, development of clouds, hazes and global abundances of various hydrocarbons in the atmosphere can now be modeled. We will present results of our ongoing investigation for the search and characterization of periodicities over half a Saturnian year, based on a non-biased a priori approach and time series techniques (such as Principal Component Analysis, PCA and Lomb-Scargle periodograms, LSP).